Review

Author(s): A. E. H. Tutton

Review by: A. E. H. Tutton

Source: *The Mathematical Gazette*, Vol. 2, No. 43 (Jan., 1904), pp. 387-389

Published by: [Mathematical Association](#)

Stable URL: <http://www.jstor.org/stable/3604351>

Accessed: 23-11-2015 04:33 UTC

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Mathematical Association is collaborating with JSTOR to digitize, preserve and extend access to *The Mathematical Gazette*.

<http://www.jstor.org>

$$\begin{aligned}
 q:r &= AE.AC:AB^2, \text{ where } BE \text{ is parallel to } AT, \text{ and meets } AC \text{ in } E \\
 &= b \sin ABE : c \sin AEB \\
 &= b \sin TAB : c \sin TAC \\
 &= bN : cM.
 \end{aligned}$$

Thus $M:N = b/q : c/r$; and similarly for $N:L$ and $L:M$.

Solution by PROPOSER.

The product of the segments of a focal chord varies as the length of the chord.

Let $(\alpha', \beta', \gamma')$ be the coordinates of focus S , QSR the focal chord parallel to BC .

Let $SQ = \rho$. The coordinates of Q are $(\alpha', \beta' - \rho \sin C, \gamma' + \rho \sin B)$.

The equation to the circumconic of ABC is

$$l\beta\gamma + m\gamma\alpha + n\alpha\beta = 0. \dots\dots\dots(1)$$

Since Q is on the conic,

$$\begin{aligned}
 &l(\beta' - \rho \sin C)(\gamma' + \rho \sin B) + m\alpha'(\gamma' + \rho \sin B) + n\alpha'(\beta' - \rho \sin C) = 0; \\
 \therefore &-\rho^2 \cdot l \sin B \sin C + \rho \{l(\beta' \sin B - \gamma' \sin C) + \alpha'(m \sin B - n \sin C)\} \\
 &\quad + l\beta'\gamma' + m\gamma'\alpha' + n\alpha'\beta' = 0; \\
 \therefore &\rho_1\rho_2 = \frac{l\beta'\gamma' + m\gamma'\alpha' + n\alpha'\beta'}{-l \sin B \sin C}; \\
 \therefore &l = \frac{l\beta'\gamma' + m\gamma'\alpha' + n\alpha'\beta'}{-\sin A \sin B \sin C} \times \frac{\sin A}{\rho_1\rho_2}; \quad l \propto \frac{\sin A}{QR};
 \end{aligned}$$

$\therefore$ substituting in (1) we have

$$\frac{a}{p\alpha} + \frac{b}{q\beta} + \frac{c}{r\gamma} = 0.$$

COR. If the conic is a parabola,

$$\frac{a}{\sqrt{p}} + \frac{b}{\sqrt{q}} + \frac{c}{\sqrt{r}} = 0.$$

If the conic is a rectangular hyperbola,

$$\frac{\sin 2A}{p} + \frac{\sin 2B}{q} + \frac{\sin 2C}{r} = 0.$$

REVIEWS.

Mathematical Crystallography and the Theory of Groups of Movements. By HAROLD HILTON, M.A.

This book may be heartily welcomed as a substantial addition to British crystallographical literature. Its object has been to collect for the use of English readers those results of the mathematical theory of crystallography which are not proved in the modern text-books in our language. The author makes no claim to originality, yet there is a considerable amount of original matter in the book, besides many new methods of presenting known mathematical facts. The proofs given in Chap. I., § 3, § 4, with respect to stereographic projection are new, as are also those of Chap. III., § 3, for the formulæ for the transformation of the indices of crystal faces from one set of axes to another, and of § 9, § 10, referring to those for the calculation of the axial ratios and facial indices from goniometrical measurements. These are decidedly important contributions to the mathematics of the subject. The student should

be warned, however, that the practical crystallographer calculates his results in most cases in a much simpler manner. Indeed, it has been the misfortune of crystallography that students are so frequently scared from the subject by the formidable formulæ given in most treatises, whereas the actual calculations are in general very much simpler than they appear, and can usually be worked out quite readily with the aid of the most elementary spherical trigonometry, provided the student is grounded beforehand in the law of anharmonic ratios and the other few fundamental laws of crystallography. New proofs are further given in Chap. IV., § 18, § 19, for the rules relating to axes of symmetry, and a considerable part of Chap. VII. (§ 3-§ 8, and the concluding notes) concerning the coordinates of equivalent points is likewise original. The proofs in Chap. IX., § 9, and Chap. XI., § 2 and § 3, relating to facial tension and capillarity constants, as well as the section of Chap. XIX. on orthorhombic holohedry, are also noticeable additions to the original literature of crystallography.

But the main feature of the book, and one for which the author has earned the gratitude of every British crystallographer, is the admirable summary which is given of the geometrical theory of crystal structure, due to the united labours of Bravais, Jordan, Sohncke, Federow, Schoenflies, and Barlow. The present is a particularly opportune moment, following on the British Association Report (Glasgow meeting, 1901) on "The Structure of Crystals," for the summarisation of the work in this direction, for it would appear to be now fairly complete. Moreover, this subject is one which has hitherto been all but untouched by English writers, with the exception of Kelvin, Barlow, and Sollas. The notation employed is chiefly that of Schoenflies, and the book contains an epitome of the great work of that author, *Krystallsysteme und Krystalstruktur*, much more readable than the latter and rendered more intelligible by numerous excellent and original figures. The same may be said of the work of Federow, whose prolific memoirs in the *Zeitschrift für Krystallographie* are by no means easy to follow. The net result of the investigations of these independent workers, in jointly yet by different methods establishing the existence of 230 different types of homogeneous structure, is set forth with conspicuous clearness, and the important fact that these types fall naturally into the 32 classes of crystal symmetry which have been experimentally discovered to exist is graphically brought home.

The book is a solid record of facts as regards the possible packing in space of the structural units of crystals—the chemical molecules or their simple aggregates—and a presentment of the indisputable mathematical foundation of these facts. Speculation concerning possible developments as regards the internal structure of the molecules themselves is avoided, yet suggestions of such inevitable developments in the future are aroused by a perusal of the later chapters of the book. Indeed, the latter appeal to the chemist quite as much as to the mathematician and physicist. A striking instance of the kind of problem upon which this new direction of enquiry into the homogeneous partitioning of space is likely to throw much light, has recently arisen. The writer of this review has been working on the relation

between the radicle ammonium, NH_4 , on the one hand, and the metals of the alkalis, potassium, rubidium, and caesium on the other. For it has been shown as the result of a study of the four isomorphous (or more strictly, eutropic) normal sulphates, that two ammonium groups replace the two atoms of potassium in the sulphate K_2SO_4 with scarcely more change in the angles and physical properties of the crystals, or in the separations of the centres of contiguous molecules along the three rectangular directions, than is observed when the two potassium atoms are replaced by two atoms of the next family analogue—rubidium; and the change is much less than when two caesium atoms are introduced instead of potassium. That is to say, 8 additional atoms are packed into the structure without disturbing the symmetry, thus proving the existence of large interspaces either between the molecular structural units or the atoms composing them, or possibly both. Indeed, it is now time that the enquiry advanced still further, into the internal structure of the molecule itself. It has been fairly conclusively shown that in the series of sulphates just referred to the simple chemical molecules are the structural units, so that this case is not further complicated, as happens in many other cases, by an aggregation of chemical molecules going to form the structural unit. Barlow has already attempted something in the way of tackling the question of internal molecular structure, and it may be hoped that as great success may attend such efforts as has crowned the work on the homogeneous partitioning of space. Problems such as that of the bestowal of the atoms of the ammonium group are constantly arising in the course of the investigations of the crystallographer, and it is by the combination of his practical work on the one hand, with such mathematical and geometrical labours as are summarised in Mr. Hilton's book on the other hand, that the highest results are to be expected, in extending our knowledge of the fundamental nature of organised solid matter. It is from this point of view that this book is so particularly welcome at the present moment.

A. E. H. TUTTON.

Calculating Scale: a substitute for the Slide Rule. By W. KNOWLES, B.A., B.Sc. (E. & F. Spon, price 1s. net.)

Mr. Knowles gives a logarithmic scale and a plain scale side by side, each 100 inches long in 20 sections each 5 inches long. From these scales three figures of number and logarithm can be read definitely and a fourth figure by estimation.

The author, in an explanatory introduction, develops the principal properties of logarithms with the aid of the scale; and brings out clearly, in a concrete manner, the nature of characteristics, a matter which often greatly confuses beginners. As an aid to the comprehension of logarithms the scale may prove very useful; but opinions will probably differ as to whether for actual use in computation it possesses much advantage compared to a card of four figure logarithms. Some years ago Messrs. Hachette of Paris published a similar scale designed by M. Dumesnil from which four figures of number and logarithm could be read definitely and a fifth figure by estimation: affording a degree of accuracy somewhat beyond four figure logarithms.

The scales of M. Dumesnil and of Mr. Knowles may be used in conjunction with a pair of dividers for the mechanical performance of various calculations after the manner of the original 'Gunter'; but they do not possess the characteristic advantage of a slide rule, to wit, that of furnishing at a single setting the answer to a whole series of numerical cases of a problem, such as "Read off distances in yards corresponding to any series of given distances in metres."

C. S. J.